

REMARKS

Claims 5-15 were previously pending in this application.

Claims 5-15 stand rejected under 35 U.S.C. 112, first paragraph.

Claims 5-8, 10-12 and 14 stand rejected under 35 U.S.C. 102(e).

Claims 9, 13 and 15 stand rejected under 35 U.S.C. 103(a).

Claim 5 is amended to clarify the patentable subject matter of the present invention.

Claim 6 is cancelled, without prejudice.

No new matter has been added.

Claims 5 and 7-15 remain in the case for reconsideration.

Applicant requests reconsideration and allowance of the claims in light of the following remarks.

Claim Rejections – 35 USC § 112

Claims 5-15 stand rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The rejection is respectfully traversed.

The Examiner alleges in the advisory action dated that “since the drawings have not been indicated as drawing to scale, thus the drawing cannot ascertain the degree of the recess.”

Although Applicant does not necessarily agree with the Examiner’s analysis stated above, to facilitate the allowance of this case, claim 5 is amended to delete the limitation “wherein the first sub-plug fills a lower portion of the contact hole to a level substantially below a top surface of the insulating layer.” Thus, the rejection of claims 5-15 under 35 U.S.C. 112 is overcome.

Claim Rejections – 35 USC § 102

Claims 5-8, 10-12 and 14 stand rejected under 35 U.S.C. 102(e) as being clearly anticipated by U.S. Pat. No. 6,380,084 issued to Lim (“Lim”)

The rejection is respectfully traversed.

Claim 5 is amended to recite:

“forming an insulating layer having a contact hole therethrough on a semiconductor substrate;

forming a diffusion barrier layer on a surface of the insulating layer and on surfaces within the contact hole;

forming a first metal layer on the insulating layer having the contact hole therethrough, the first metal layer having a void therein below a top surface of the insulating layer;

etching back the first metal layer to the depth of the void to form a first sub-plug without the void in a lower portion of the contact hole; and

forming a second sub-plug that fills an upper portion of the contact hole on the first sub-plug.” Support for these amendments are found in the specification, for example, at page 4, lines 20-21 and 24-25; and page 5, lines 14-15.

In contrast, Lim is merely directed to solving two problems, i.e., 1) the significant increase of parasitic capacitance of the interconnect structure due to the use of etch stopping layers; and 2) degraded properties of the copper layer due to the difficulty of controlling the deposition rate of the copper layer in the formation of dual damascene copper interconnects. See col. 1, lines 51-66 of the Lim patent.

Nowhere does Lim teach the void problem of the instant application, i.e., a metal layer having a void in the contact hole (page 1, lines 19-20), not to mention the method of solving the void problem, i.e., “etching back the first metal layer to the depth of the void to form a first sub-plug without the void in a lower portion of the contact hole,” as recited in claim 5 of the instant application.

Further, the Examiner alleges in the advisory action that FIG. 15 of Lim shows the layer 64 being etched below the surface of the insulating layer. However, the layer 64 is etched merely below the surface of the shielding (metal) layer 56, not below the top surface of the insulating layer 52.

Thus, nothing in Lim teaches or discloses the above limitations of the claimed invention recited in claim 5.

Accordingly, Lim does not teach or disclose all of the elements of claim 5 and, thus, does not anticipate claim 5, especially in view of the amendment. Also, claims 6-8, 10-12 and 14, which depend from allowable claim 5 and recite features that are neither disclosed nor taught by Lim, are allowable.

Claim Rejections – 35 USC § 103

Claims 9 and 13 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lim as applied to claim 5 above, and further in view of U.S. Patent No. 5,801,096 issued to Lee ("Lee").

Claim 15 stands rejected under 35 U.S.C. 103 (a) as being unpatentable over Lim as applied to claim 8 above, and further in view of Grill et al ("Grill"). (U.S. Pub. No. 2002/0127844).

The rejection is respectfully traversed.


For the reasons discussed above, none of the cited references including Lim, either alone or in combination, teach or suggest the limitations recited in claims 9, 13 and 15, which depend from allowable claim 5. Further, Grill is not a proper prior art reference because the Grill patent application was filed on May 13, 2002 while the instant application was filed on September 17, 2001.

Thus, the Examiner has not presented a *prima facie* case of obviousness. Accordingly, claims 9, 13 and 15, which depend from allowable claim 5 and recites features that are neither or disclosed by the prior art, are also allowable.

For the foregoing reasons, reconsideration and allowance of claims 5 and 7-15 of the application as amended is solicited. The Examiner is encouraged to telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.

Respectfully submitted,

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